



# Update on French R&D programs on end use energy technologies

R&D country report to the International Energy Agency  
End Use Working Party (IEA – EUWP)

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## Comments

The results presented in this report are focused on end uses energy technologies. The R&D activities related to renewable energy, fossil fuels, hydrogen and fusion power are not discussed here.

This report doesn't have the pretension to be exhaustive. Nevertheless, it tries to present in some pages the key elements (eg. R&D priority topics, budget, result evaluation) and the key R&D policy measures that could characterise the recent R&D activities on end use energy technologies.

The last French R&D country report dating from 2006, this report proposes an overview of the key facts that could illustrate the French R&D activities on end uses energy technologies between 2005 and 2008.

The recent R&D activities dating from the late 2008 or early 2009 will be presented and discussed in the next report (country report 2010).

All the comments on this report can be sent by email to Michel GIORIA ([michel.gioria@ademe.fr](mailto:michel.gioria@ademe.fr))

# Update on French R&D programs on end use energy technologies

Country report for France

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## I. Setting the scene :

Following the Chambolle report<sup>2</sup> on new energy technology R&D published in 2005 by the French Ministry on R&D, the French energy R&D landscape have knew many deep evolutions.

Concerning the end use energy technology which are under the scope of the IEA End Use Working Party (building, industry, electricity and transport), the main evolutions can be summarized by :

- The launch of a national R&D and experimentation program on building and energy (the PREBAT) ;
- The update of the national R&D program on terrestrial transport and energy (the PREDIT) ;
- The creation of a national R&D program on intelligent electricity grid ;

More recently, the “Grenelle de l’Environnement” process, which aims to foster the transition toward a low carbon and more sustainable economy, has created a new dynamic.

The R&D demonstrator fund on new energy technology funded with 400 million euros over the period 2008 – 2012 (100 million euros a year) illustrates this new dynamic.

Even if the perimeter of the R&D demonstration fund is wider than the scope of the IEA end use energy technology working party, it seems relevant to present this fund in this country report because it shows the importance that the French government gives to RD&D on new energy technology.

Then, after an overview of the recent trends in R&D expenditure on end use energy technology, this country report will highlight the main results achieve since 2005 in the three

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<sup>1</sup> French delegate to the IEA end use working party since October 2008.

<sup>2</sup> <http://www.enseignementsup-recherche.gouv.fr/cid20917/nouvelles-technologies-de-l-energie.html>

main domestic R&D programs on end use technologies<sup>3</sup> : the PREBAT<sup>4</sup>, the PREDIT<sup>5</sup> and the intelligent electricity grids

The report will conclude by a presentation of the R&D demonstration fund focused on new energy technology (e.g. second generation biofuels, low emission individual vehicle, intelligent electricity grid).

## II. A strong financial effort :

A study performed in 2007 by the French Ministry on energy, environnement, sustainable planning and development enables us to reconstitute the public R&D expenditure related to end use energy technologies.

The table below shows that between 2004 and 2007, the public R&D expenditure related to end use energy technologies have increased by around 68%.

In absolute term, the public R&D expenditure related to end energy technologies jumped from 75 million euros in 2004 to more than 126 million euros in 2007.

In 2007, the public R&D expenditure related to end use energy technologies represented a share of around 15 % in the overall public R&D expenditure on energy which includes nuclear, renewable and fossil fuel energies.

### Recent trend in public R&D expenditure on end use energy technologies

|  | <b>2004</b> | <b>2005</b> | <b>2006</b>  | <b>2007</b>  | <b>Rate of Growth</b> |
|--|-------------|-------------|--------------|--------------|-----------------------|
| <b>Energy efficiency in Industry</b>                             | 9,7         | 10,5        | 7,1          | 11,8         | <b>21,65 %</b>        |
| <b>Energy efficiency in Residential and commercial</b>           | 10,3        | 14,0        | 15,1         | 21,4         | <b>107,77 %</b>       |
| <b>Energy efficiency in transport</b>                            | 36,5        | 38,9        | 54,8         | 51,4         | <b>40,82 %</b>        |
| <b>Fuel Cells (for stationary and non stationary appliances)</b> | 14,2        | 31,4        | 29,6         | 31,5         | <b>121,83 %</b>       |
| <b>Electricity transmission, distribution and storage</b>        | 4,3         | 2,5         | 2,3          | 10,4         | <b>141,86 %</b>       |
| <b>Total</b>   | <b>75</b>   | <b>97,3</b> | <b>108,9</b> | <b>126,5</b> | <b>68,67 %</b>        |

Source : French Ministry on environnement, energy, sustainable planning and development.

<sup>3</sup> Carbon Capture and storage is not retains in this review because it is more related to energy supply, even if the capture technologies could addressed for a while energy efficiency of the process.

<sup>4</sup> Research and Experimentation program on building and energy.

<sup>5</sup> Research and Experimentation program on terrestrial transport and energy.

### III. The PREBAT<sup>6</sup> :

Launched in 2005 to create a coherent and shared framework for the R&D on energy efficiency in the building, the PREBAT is nowadays under evaluation. This evaluation aims to :

- identify the strength and weakness of the activities launched under the program between 2005 and 2008 (e.g. call of tender, experimentation program on low energy consumption buildings, international benchmark) ;
- define corrective actions to improve the efficiency of future activities that will be performed under the PREBAT framework.

These days, the PREBAT involves the 6 ministries and agencies which financed R&D projects and experimentations on energy efficiency in buildings : ADEME<sup>7</sup>, ANR<sup>8</sup>, OSEO, ANRU, ANAH and DGUHC.

Over the period 2005 – 2008, the PREBAT has been funded with a budget close to 62 millions euros.

This R&D program is structured around 4 working groups (economics and sociology, technologies for energy efficiency in the buildings, new buildings and existent building).

The members of this working groups proposed to the steering committee of the program :

- The topics that should be opened in the future R&D or experimentation calls ;
- The budget that should be allocated to the different topics (eg. technologies to improve energy efficiency, energy poverty in the building) to achieve substantial results on a specific thematic.

Since 2005, 4 R&D calls have been launched under the supervision of the PREBAT :

- 2 R&D calls on technologies to improve the buildings energy efficiency. In this 2 calls, 4 R&D priorities was highlighted : buildings envelop and structure, buildings equipment, buildings modelling, and transversal technical approaches for buildings energy efficiency ;
- 1 R&D call on economics and sociology applied to the improvement of energy efficiency in the building ;
- 1 R&D call on energy poverty in the building which aimed to gather R&D projects to improve the understanding of the energy poverty mechanism and to identify policy tools to solve it.

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<sup>6</sup> <http://www.prebat.net/>

<sup>7</sup> French agency for environment and energy managment.

<sup>8</sup> National research agency

In addition to these R&D calls, several regional calls have been launched under the PREBAT framework to gather experimentation projects on low energy consumption buildings.

At these days, 18 out of 22 administrative regions have launched one or two experimentation calls. 124 experimentation projects have already been selected. 75% of the projects already selected concerned new buildings (only 25% of the already selected projects concerned existent buildings) and 70% of this same set of projects concerned residential building (30% of the already selected project concerned commercial buildings).

To be selected and financed, the experimentation projects have to respect minimum technical requirement essentially defined as maximum unit consumption ratio for the different sort of buildings (see table below).

**Technical requirement for the regional experimentation calls on low energy consumption buildings**

|                              | <b>New buildings</b>                            | <b>Rehabilitation</b>   |
|------------------------------|---|---|
| <b>Residential buildings</b> | 50 kWh / m <sup>2</sup>                         | 80 kWh / m <sup>2</sup> or a division by 4 of the energy consumption after the rehabilitation |
| <b>Commercial buildings</b>  | CREF manus 50 % (or manus 40% in specific case) | CREF or a division by 4 of the energy consumption after the rehabilitation                    |

#### **IV. The PREDIT<sup>9</sup> :**

The research, development and experimentation program on terrestrial transport (the PREDIT) has been renewed in 2002 for a period of 6 years (until 2007).

After an evaluation performed in the early 2008 by external experts, the PREDIT has been renewed also for a 6 years period until 2013. The choice of the starting and ending dates for this new PREDIT (so called PREDIT number 4) was made to suit with the calendar of the European R&D Framework Program which is also a key funding tool for R&D on terrestrial transport.

The key results of the evaluation performed in 2008 can be summarized in 3 points:

- Simplify the running of the program, especially by a reduction of the working group numbers (the PREDIT number 3 was structured around 11 working groups) ;
- Improve the coordination between the PREDIT and the transport and energy topics of the European framework program ;
- Intensify the relation between the technological and public policy groups of the PREDIT, especially for the merchandise transportation.

<sup>9</sup> <http://www.predit.prd.fr/predit3/homePage.fo>

From 2002 to 2007, around 300 millions euros has been invested by different French Ministries and agencies to financed R&D projects under the PREDIT framework.

On this 300 millions euros global budget :

- 48% (140 millions euros) have been invested in R&D projects related to energy and environment ;
- 87% have been invested in R&D project with a strong technological component (versus R&D project oriented towards improvement of the knowledge for public policies).

From 2008 to 2013, the PREDIT 4 should be funded with a budget close to 400 million euros. On these 400 million euros, the energy – environment topics should receive a budget close to 145 millions euros.

Compared to the PREDIT 3, the PREDIT 4 is structured around “only” 6 working groups which are in charge of :

- The identification of R&D priority topics in their fields. Afterwards, this topics are presented to the PREDIT steering committee which takes the final decision ;
- The writing and the launch of R&D call ;
- The monitoring of the projects after their selection by external expert ;
- The valorisation of R&D project results

For the next 6 years, the PREDIT 4 will focus on 6 priorities: energy and environment, transportation system quality, information and communication system applied to terrestrial transport, mobility in urban area, competitiveness of transportation industry and merchandise transportation.

## **V. The intelligent electricity grid program**

As a means to transport the electricity from power plants to consumers, the transmission and distribution network is a key component of the electricity system.

The liberalisation of the European electricity markets and the European incorporation objectives of renewable electricity in final electricity consumption create a new set of constraints for the electricity network.

In this situation, the electricity grid stakeholders have four options to recover some degree of freedom in the way they manage the grid:

- Improve the predictability of the production from intermittent renewable energy power plan ;

- Optimise the size and the localisation of the renewable power plants, regarding the availability of the renewable resources (eg. wind, sun) in different area at different period of time ;
- Insert directly on the grid or in addition to the renewable power plan electricity storage capacity ;
- Improve the intelligence of the grid to permit the development of wide demand side management program to smooth the load curve, monitor the comportment of different group of customers, and propose more incentive tariff schemes...

These four options to relax the constraint on the electricity grid create new needs of scientific, technical and socio-economics knowledge.

To address this need of knowledge and foster the transition towards smart grid, the ADEME launched in 2007 a coordination project which aim to :

- Identify French private and public R&D stakeholders that should be involved in a national program on intelligent electricity grid ;
- Identify research needs in 5 areas : transmission, distribution, interaction between transmission and distribution networks, demand side management and connection of renewable power plans on the distribution grid ;
- Think over about the funding scheme that could be implemented to fund these new R&D priorities. As an illustration, the funding needs estimated by the different stakeholders to finance this new R&D priorities was close to 50 millions euros for the next 5 years (around 10 millions euros a year) ;
- Set up a national R&D program in close relation with the European initiative in this thematic area (eg. European technological platform on smart grid, energy topic of the European R&D framework program).

The result of this project was presented in a final conference in Paris (February 2008) with the close collaboration of the European Commission (DG RTD) and the main French industrials (EDF, GDF, Areva, Schneiders...).

The around 100 hundred R&D priorities identified in this project have been illustrated by 57 project summaries.

After an internal selection regarding its R&D objectives on this thematic, the ADEME picks up 12 projects (out of 57) for a follow up. Nowadays these 12 projects are under implementation or should be implemented in the coming year.

## Illustration of the R&D projects financed by the ADEME on intelligent electricity grids

| Thematic of the projects   | Cost (k€) |
|--|-----------|
| Probabilistic methodology to optimise the connection of renewable energy power plan to the distribution grid         | 2 000     |
| The contribution of the demand side management to provide service to the transmission and distribution grid operator | 200       |
| Specification of standardised interfaces for the connexion of storage capacities to the grid                         | 3000      |
| Methodology to assess cost and benefice of electricity storage   | 260       |
| Methodology to estimate the margin of the grid operator in real time   | 900       |

## VI. The demonstrator fund:

Launch in the mid of 2007 to foster the transition towards a low carbon and more sustainable economy, the “Grenelle de l’Environnement” process is now under implementation phase.

From an R&D view point the main measure identified during the “Grenelle de l’Environnement” process was the creation of a R&D demonstrator fund focused on new energy technologies (eg. second generation biofuels, low emission individual vehicles, capture and geological storage of CO<sub>2</sub>).

Created by the French government in mid 2008, the R&D demonstrator fund is under the administrative and financial management of the ADEME which implements the recommendation of the fund steering committee composed with the different Ministries concerned by the thematic.

The R&D demonstration fund should have a life time of 4 years (2008 – 2012) and will be founded with 400 million euros over this period.

Still the mid 2008, three calls of interest have already been launched: 2<sup>nd</sup> generation biofuels, low emission individual vehicles, and capture and geological storage of CO<sub>2</sub>.

For 2009, 2 additional calls of interest are in preparation. The first one on intelligent electricity grid and the second one on marine energy (eg. tidal energy, wave energy)

For each call of interest, the project team who manage the demonstrator fund implement a demarche in 5 steps:

- The construction of a thematic roadmap with key internal and external experts from public and private research centers ;
- The writing and launch of a call of interest ;
- The technical expertise and evaluation of the proposition received ;
- The presentation of the proposition and the expertise results to the funds steering committee for a final decision ;

- The notification of the project to the European Commission (only if one of the project partner request more than 7,5 millions euros of subvention) ;
- The implementation of the R&D demonstration project ;
- The ex post evaluation of the project, and the identification of the new R&D needs created by the implementation of the R&D demonstrator.

At this time, 8 R&D demonstration projects (all related to the low emission individual vehicle call of interest) has already been selected by the funds steering committee.

This 8 R&D demonstration projects represent an amount of subvention close to 36 million euros.

## **VII. Conclusion**

Since 2005, the French energy R&D landscape has known many evolutions. The energy end uses technologies are particularly concerned by this evolution which can be characterised by :

- A strong increase of the financial effort dedicated to end use energy technologies R&D ;
- The creation of two national R&D and experimentation programs. The first one on buildings and the second one on intelligent electricity grid ;
- The update of the national R&D and experimentation program on terrestrial transport ;
- The creation of the R&D demonstration fund on new energy technologies.

More recently, the creation of a public – private fund between the ADEME and Total, the French oil company, to finance R&D projects on energy efficiency in industrial utilities and the creation of a national R&D platform on hydrogen and fuel cells (HyPAC) give evidence in a very dynamic environment for end use energy technologies R&D.